



Flash Drive Data Recovery educational webinars

Chip-off NAND data recovery with Visual NAND reconstructor consists of several essential steps whose task is to reverse transformations which controller applied on user data. In those education webinars, you will find out how to extract raw dumps from NAND memory chips, how to correct them using written ECC codes, how to assemble blocks into a logical order, and much more.

Chip reading, ECC usage, Page layout, Dump reread, Read Retry.



00:00 - VNR case types

01:34 - NAND chip and NAND adapter types

05:55 - The configuration

08:17 - ID reading. Configuration selection

16:45 - Configuration test. Data quality test

28:52 - The Voltage control

38:34 - How to select a configuration if there are several of them. SDR and

DDR protocols

47:16 - ECC

58:43 - PAGE structure

01:03:11 - Case study. Phison controller ECC applying and Page layout setting

01:17:07 - ECC codeword test

01:22:19 - Case study. SM controller ECC applying and Page layout setting

01:25:02 - Case study. AU controller ECC applying and Page layout setting

01:28:40 - Case study. Sandisk controller ECC applying and Page layout setting

01:31:08 - DUMP rereading. How to fix uncorrectable by ECC pages.

01:43:03 - Read Retry

The link to PDF presentation:

https://drive.google.com/file/d/1E_pQCj5ZSAgV60XgCIIVnw6Lp85kjkIB/view

Bad Column Remover. Case studies.



00:00 - New automated Bad Column Remover

10:27 - Phison controller bad columns removal

45:58 - SM controller bad columns removal

56:34 - AU controller XORed bad columns removal

01:02:06 - Unknown controller 283 bad columns removal

The link for the test cases:

<https://drive.google.com/drive/folders/19Sz7MW6oL2grF9T0pTFzVd0ACrOneyvZ>

Page structure analysis and reverse engineering of BCH codewords from unsupported devices.



2:03 - NAND page structure

12:03 - Manual Page layout setting in VNR

46:41 - BCH codeword

55:10 - Manual BCH codeword detection

1:06:34 - "Codeword analysis" usage, BCH codeword Bruteforce

1:18:50 - Case study. Manual PAGE layout setting and BCH codeword detection for SM controller

1:24:26 - ECC size and position detection in fully XORed page

1:34:50 - SM service area ECC detection

1:43:32 - Case study. Manual PAGE layout setting and BCH codeword detection for AU controller

1:54:50 - Case study. Manual PAGE layout setting and BCH codeword detection for SanDisk controller

The link to PDF presentation:

<https://drive.google.com/file/d/1JSubQgCmYILgMQXgeLARCo7mez47OVXo/view>

Inversion. Data transformation analysis. XOR, XOR analyser.



- 1:41 - Inversion
- 5:19 - Scrambling (XOR)
- 8:28 - Inversion detection. Data transformation analysis
- 14:58 - Case study. Inversion is not used
- 24:42 - Case study. Inversion is used
- 34:05 - XOR analysis. XOR analyzer
- 1:07:52 - Case study. XOR transformation elimination. SM controller
- 1:17:32 - Case study. XOR transformation elimination. AU controller
- 1:21:50 - XOR key extraction from a patient dump (overview)
- 1:24:35 - Case study. XOR transformation elimination. SanDisk controller
- 1:29:59 - Phison dynamic XOR
- 1:32:47 - Case study. Dynamic XOR transformation elimination. Phison controller
- 1:36:13 - Logical block size check and adjustment
- 1:44:39 - "Adjust key to page layout" explanation

The link to PDF presentation:

<https://drive.google.com/file/d/1ENuoGtkGmoOjVIUtKvLqIVf83714Yi80/view>

XOR key extraction from the dump. XOR key adjustment. XORed SA.



- 0:33 - Data Scrambling (XOR)
- 1:18 - Descrambling (XOR elimination)
- 2:30 - XOR key selection
- 4:41 - XOR key extraction
- 24:19 - XOR key types
- 28:52 - Adjust key to the page layout
- 31:58 - Case study. XOR key extraction, Phison controller
- 34:20 - Number of Xor keys in one block determination
- 44:26 - Case study. XOR key extraction, SM controller
- 46:09 - XOR key signature
- 58:54 - Existing XOR key from database fitting. XOR key size adjustment.
- 1:05:54 - Extract Area tool
- 1:09:46 - Case study. XOR key size adjustment. SA XOR key extraction.
- 1:17:41 - SA XOR key extraction

The link to the PDF:

<https://drive.google.com/file/d/1joQhQktnvwoOQuTlzYMZg1ADvjKHB0KC/view>

Multi-Plane page allocation. Pair and Unite usage.



- 1:21 - NAND memory internal structure
- 2:51 - Page allocation modes
- 10:34 - NAND chip block reading/ the reason of page mix in a dump
- 11:52 - Single-plane page allocation in a dump
- 12:33 - Multi-plane page allocation in a dump/ PAIR element
- 17:27 - Multi-plane page allocation detection
- 25:46 - Multi-plane page allocation on the chip level/ UNITE element
- 39:05 - Case study. One dump. PAIR is used.
- 53:15 - Case study. Two dumps. PAIR is NOT used. Unite by DUMPS is applied.
- 1:00:22 - Case study. Two dumps. PAIR is used. UNITE by PAGES is applied.
- 1:12:04 - Case study. Four dumps. PAIR is used. UNITE by PAGES and then UNITE by DUMPS are applied.
- 1:21:51 - Case study. Four dumps. PAIR is used. UNITE by PAGES is used.
- 1:26:27 - Order of dumps for the UNITE detection

Link to the PDF presentation and test cases:

<https://drive.google.com/file/d/1919HV4o7-ZN8pGpNLg4GM1mPcwmYi72L/view>

Block management. LBN, headers, Marker table.



- 0:00 - NAND Data recovery process review
- 5:26 - Block management explanation
- 12:55 - The Header
- 20:25 - The Logical block number
- 25:15 - Inverted LBN
- 27:26 - LBN Little-endian order
- 29:03 - The LBN and header location in the service area.
- 32:15 - Block management step-by-step script
- 37:07 - NAND Data recovery case step-by-step demonstration in the VNR
- 39:25 - BCH element usage in the VNR
- 41:53 - Page layout determination
- 46:06 - XOR analyzer usage
- 48:39 - Multiplane page allocation. PAIR element usage
- 51:20 - PS2251-50-F Block management
- 52:19 - The LBN and header search in the SA (Phison controller)
- 1:04:22 - Filtering by Header (Phison controller)
- 1:09:07 - Filtering by LBN range
- 1:13:21 - Duplicated blocks
- 1:18:26 - Missing blocks
- 1:22:18 - SM3255QAB Block management
- 1:24:28 - The LBN and header search in the SA (SM controller)
- 1:30:29 - Inverted LBN
- 1:34:48 - Filtering by Header (SM controller), Header range determination
- 1:45:38 - AU6983 Block management
- 1:52:00 - Banks
- 2:08:12 - SM321QF AC Block management
- 2:09:35 - Can't see the header and LBN precisely
- 2:24:33 - LBN little-endian order example

- 2:33:36 - LBN chain check
- 2:43:08 - Particular file block number detection
- 2:45:54 - AU6989SN Block management
- 2:49:24 - XORed bad columns removal
- 3:01:44 - Correct data block selection when there is no header
- 3:08:12 - Non-standard LBN chain test step
- 3:17:24 - SM325AC Block management
- 3:21:44 - The Mask usage

The link to the PDF presentation:

<https://drive.google.com/file/d/1D0yhjvYGuZIIaC2MHSverMgddLL-UNuF/view>

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